CLAIMS

1. A recording medium used for storing data, comprising:

a digital stream generated by multiplexing a video stream and a graphics stream, wherein:

the graphics stream includes a plurality of display sets each of which is used for a graphics display;

the display set includes a control segment and graphics data, the control segment including time information that designates an active period of the control segment in the display set on a reproduction time axis of the video stream; and

when the active period of the control segment in the display set overlaps with an active period of a control segment in an immediately preceding display set, the time information designates the active period of the control segment in the display set to start at or after a time at which, during the active period of the control segment in the immediately preceding display set, transfer of graphics generated by decoding graphics data in the immediately preceding display set is completed.

2. The recording medium of Claim 1, wherein:

the active period of the control segment in the display set is from a decoding start time of the control segment

in the display set to a display start time of the graphics display which is composited based on the control segment in the display set.

3. The recording medium of Claim 2, wherein:

the control segment in the display set is provided at a beginning of the display set in a state of being contained within one packet;

the time information includes a decoding time stamp and a presentation time stamp which are written in the packet; and

the decoding time stamp shows the decoding start time, and the presentation time stamp shows the display start time.

4. The recording medium of Claim 1, wherein:

the graphics data in the display set is made up of a sequence of pieces of graphics data a last one of which is immediately followed by an end code; and

a time stamp associated with the end code shows a transfer completion time of the last piece of graphics data.

5. The recording medium of Claim 4, wherein:

the sequence of pieces of graphics data includes a

piece of referenced graphics data which is referenced by the control segment in the display set and a piece of non-referenced graphics data which is not referenced by the control segment in the display set;

the piece of referenced graphics data and the piece of non-referenced graphics data are arranged in the display set in the stated order;

the sequence of pieces of graphics data is to be sequentially decoded in the order of the arrangement; and

the end code immediately follows the last piece of graphics data.

6. The recording medium of Claim 1, wherein:

the display set further includes window information that specifies a position, a height, and a width of a window on a screen, the window being a rendering area in which the graphics display is to be composited based on the control segment in the display set before being overlaid on a moving picture represented by the video stream; and

a time period from an end of the active period of the control segment in the immediately preceding display set to an end of the active period of the control segment in the display set is equal to a time period required for writing into the entire rendering area.

7. The recording medium of Claim 1,

wherein the active period of the control segment in the display set overlaps with the active period of the control segment in the immediately preceding display set if the display set and the immediately preceding display set belong to a same unit of memory management in the graphics stream; and

if the display set and the immediately preceding display set belong to different units of memory management in the graphics stream, the time information designates the active period of the control segment in the display set to start at or after an end of the active period of the control segment in the immediately preceding display set.

8. The recording medium of Claim 1, wherein:

the graphics stream is a presentation graphics stream which is intended to synchronize with a moving picture represented by the video stream or an interactive graphics stream which is intended to produce an interactive display;

the active period of the control segment in the display set overlaps with the active period of the control segment in the immediately preceding display set if the graphics stream is the presentation graphics stream; and

if the graphics stream is the interactive graphics

stream, the time information designates the active period of the control segment in the display set to start at or after an end of the active period of the control segment in the immediately preceding display set.

9. A reproduction apparatus for reproducing a digital stream generated by multiplexing a video stream and a graphics stream, comprising:

a video decoder operable to decode the video stream to generate a moving picture; and

a graphics decoder operable to decode the graphics stream to generate graphics, and overlay the graphics and the moving picture, wherein:

the graphics stream includes a plurality of display sets each of which is used for a graphics display, the display set including a control segment and graphics data; and

the graphics decoder performs pipeline processing, by starting processing the display set at or after a time at which, during an active period of a control segment in an immediately preceding display set, transfer of graphics generated by decoding graphics data in the immediately preceding display set to a buffer is completed.

10. The reproduction apparatus of Claim 9, wherein:

the buffer is an object buffer for storing graphics generated by decoding;

the graphics decoder includes:

a processor operable to decode the graphics data in the display set to generate graphics, and transfer the graphics to the object buffer; and

a controller operable to read graphics from the object buffer based on the control segment in the display set, and overlay the read graphics and the moving picture; and

in the pipeline processing, the processor transfers the graphics generated by decoding the graphics data in the display set to the object buffer, whilst simultaneously the controller reads graphics from the object buffer based on the control segment in the immediately preceding display set.

11. The reproduction apparatus of Claim 10, wherein:

the control segment in the display set is provided at a beginning of the display set; and

the controller decodes the control segment, and, in accordance with a decoding result of the control segment, reads the graphics from the object buffer and displays the read graphics.

12. The reproduction apparatus of Claim 11, wherein:

the control segment in the display set is contained within one packet; and

the controller starts decoding the control segment at a time shown by a decoding time stamp written in the packet, and starts displaying the graphics at a time shown by a presentation time stamp written in the packet.

13. The reproduction apparatus of Claim 10, wherein:

the graphics data in the display set is made up of a sequence of pieces of graphics data a last one of which is immediately followed by an end code; and

a time stamp associated with the end code shows a transfer completion time of the last piece of graphics data.

14. The reproduction apparatus of Claim 13, wherein:

the sequence of pieces of graphics data includes a piece of referenced graphics data which is referenced by the control segment in the display set and a piece of non-referenced graphics data which is not referenced by the control segment in the display set;

the piece of referenced graphics data and the piece of non-referenced graphics data are arranged in the display set in the stated order; and

the processor sequentially decodes the sequence of

pieces of graphics data in the order of the arrangement and transfers graphics generated by the decoding to the object buffer.

15. The reproduction apparatus of Claim 14, wherein:

the display set further includes window information that specifies a position, a height, and a width of a window on a screen, the window being a rendering area in which the graphics display is to be composited based on the control segment in the display set before being overlaid on the moving picture;

the controller displays the graphics display composited based on the control segment in the display set, a predetermined time period after displaying a graphics display composited based on the control segment in the immediately preceding display set; and

the predetermined time period is equal to a time period required for writing into the entire rendering area.

16. The reproduction apparatus of Claim 9, wherein:

the graphics decoder performs the pipeline processing if the display set and the immediately preceding display set belong to a same unit of memory management in the graphics stream; and

if the display set and the immediately preceding

display set belong to different units of memory management in the graphics stream, the graphics decoder starts processing the display set at or after a time at which display of the graphics display composited based on the control segment in the immediately preceding display set is started.

17. The reproduction apparatus of Claim 9, wherein:

the graphics stream is a presentation graphics stream which is intended to synchronize with the moving picture or an interactive graphics stream which is intended to produce an interactive display;

the graphics decoder performs the pipeline processing if the graphics stream is the presentation graphics stream; and

if the graphics stream is the interactive graphics stream, the graphics decoder does not perform the pipeline processing.

18. A method of recording onto a recording medium, comprising the steps of:

generating application data; and

recording the application data to the recording medium, wherein:

the application data includes a digital stream

generated by multiplexing a video stream and a graphics stream;

the graphics stream includes a plurality of display sets each of which is used for a graphics display;

the display set includes a control segment and graphics data, the control segment including time information that designates an active period of the control segment in the display set on a reproduction time axis of the video stream; and

when the active period of the control segment in the display set overlaps with an active period of a control segment in an immediately preceding display set, the time information designates the active period of the control segment in the display set to start at or after a time at which, during the active period of the control segment in the immediately preceding display set, transfer of graphics generated by decoding graphics data in the immediately preceding display set is completed.

19. A computer-readable program used for enabling a computer to reproduce a digital stream generated by multiplexing a video stream and a graphics stream, the program enabling the computer to perform the steps of:

decoding the video stream to generate a moving picture; and

decoding the graphics stream to generate graphics, and overlaying the graphics and the moving picture, wherein:

the graphics stream includes a plurality of display sets each of which is used for a graphics display, the display set including a control segment and graphics data; and

the step of decoding the graphics stream perform pipeline processing, by starting processing the display set at or after a time at which, during an active period of a control segment in an immediately preceding display set, transfer of graphics generated by decoding graphics data in the immediately preceding display set to a buffer is completed.

20. A method of reproducing a digital stream generated by multiplexing a video stream and a graphics stream, comprising the steps of:

decoding the video stream to generate a moving picture; and

decoding the graphics stream to generate graphics, and overlaying the graphics and the moving picture, wherein:

the graphics stream includes a plurality of display sets each of which is used for a graphics display, the

display set including a control segment and graphics data; and

the step of decoding the graphics stream performs pipeline processing, by starting processing the display set at or after a time at which, during an active period of a control segment in an immediately preceding display set, transfer of graphics generated by decoding graphics data in the immediately preceding display set to a buffer is completed.

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